

4th Chemical Process Safety Sharing (CPSS)



Chemical
Process Safety Sharing

*Topic : Full Surface Fire Fighting and
Improvement for Crude Tank Area*

*Present Name : Songpol Prommoon
Position : Process Eng.
Company: IRPC*





CONTENT

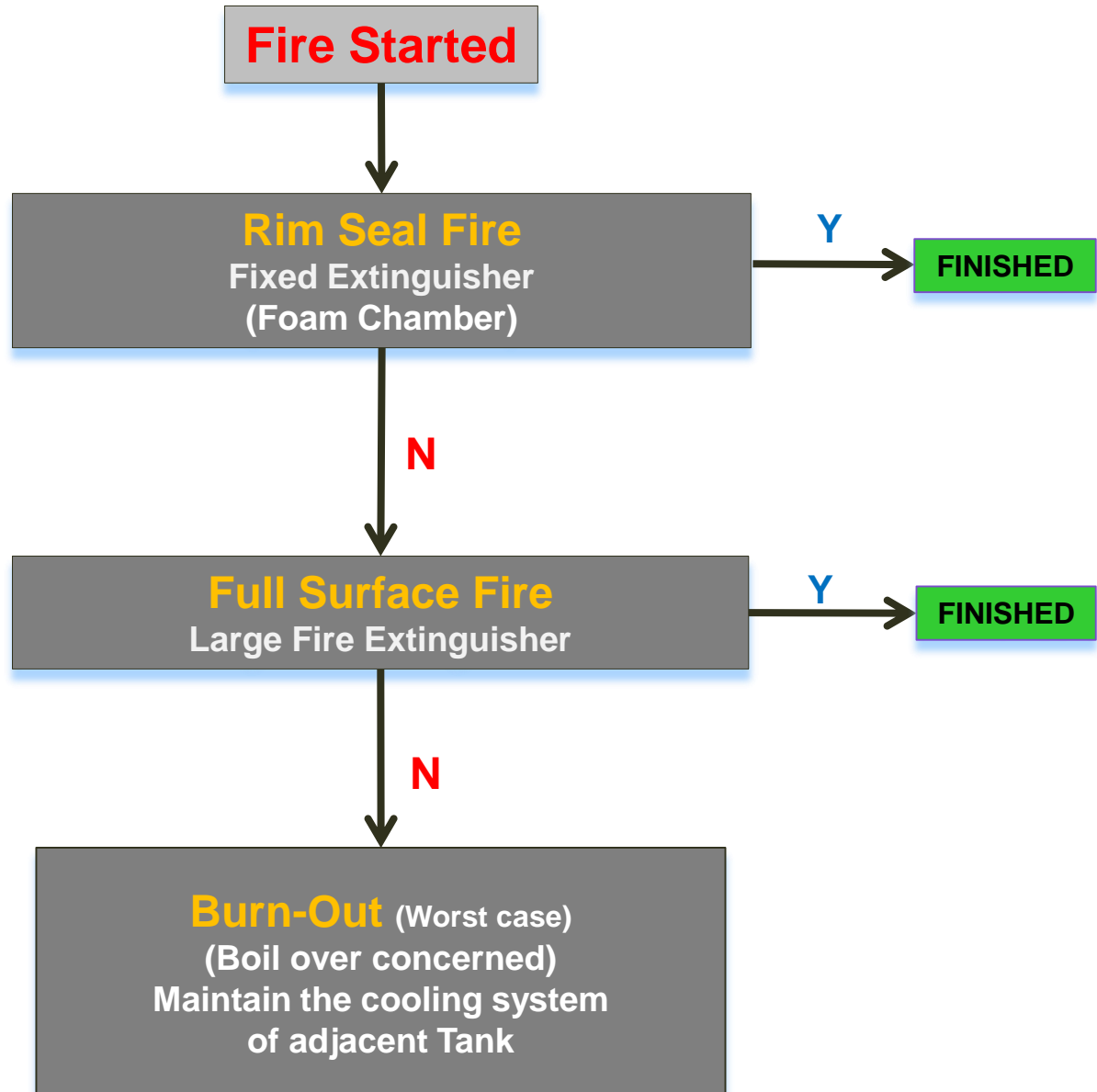


- A. BACKGROUND**
- B. CRITERIA and STANDARD**
- C. HEAT RADITION LEVEL**
- D. FIRE WATER/FOAM DEMAND and SUPPLY**
- E. IMPROVEMENT**



BACKGROUND

FIRE EXPANSION





BACKGROUND

COST of FAILING



Involving a 90 metre Crude Oil Tank

Values are based on a 22 metre high tank containing 876,494 bbls, with a Crude Oil Value of US\$50.00/bbl, and a conservative burn rate of 1 ft/hr (305 mm/hr) is indicated in red text – burn rates for crude oil can range from 0.98 ft/hr (300 mm/hr) to 1,97 ft/hr (600 mm/hr), costs for a burn rate of 1.97 ft/hr (600 mm/hr) are indicated in in blue text in parenthesis.

Loss per second: US\$ 169.08 (US\$ 333.08)

Loss per hour: US\$ 608,676.27 (US\$ 1,199,092.25)

Total value of contents:* US\$ 43,824,691.30

**Does not include cost of tank, loss of production, nor impact on share value of company*

Involving an 80 metre Crude Oil Tank

Values are based on a 22 metre high tank containing 691,365 bbls, with a Crude Oil Value of US\$50.00/bbl, and a conservative burn rate of 1 ft/hr (305 mm/hr) is indicated in red text – burn rates for crude oil can range from 0.98 ft/hr (300 mm/hr) to 1,97 ft/hr (600 mm/hr), costs for a burn rate of 1.97 ft/hr (600 mm/hr) are indicated in in blue text in parenthesis.

Loss per second: US\$ 133.37 (US\$ 262.73)

Loss per hour: US\$ 480,114.61 (US\$ 945,825.78)

Total value of contents:* US\$ 34,568,251.77

**Does not include cost of tank, loss of production, nor impact on share value of company*





SCOPE

CRUDE TANKs





SCOPE



- To determine *fire radiation contour* of full surface tank fire incident at 69T050A and 69T080D using PHAST simulation software
- To determine *fire water consumption* by the international concerning standard
- Using FATHOM simulation model in order to *perform hydraulic calculation* of the existing fire water distribution system
- To propose scheme to *lessen the constraints of the existing fire water system*
- To propose *the necessary for full surface fire fighting scenario* such as Hydrant Manifold, Cooling down system, Booster pump, Big-Gun, Hose and Cooperation group.



SCG



GC



PTT

ES

IRPC





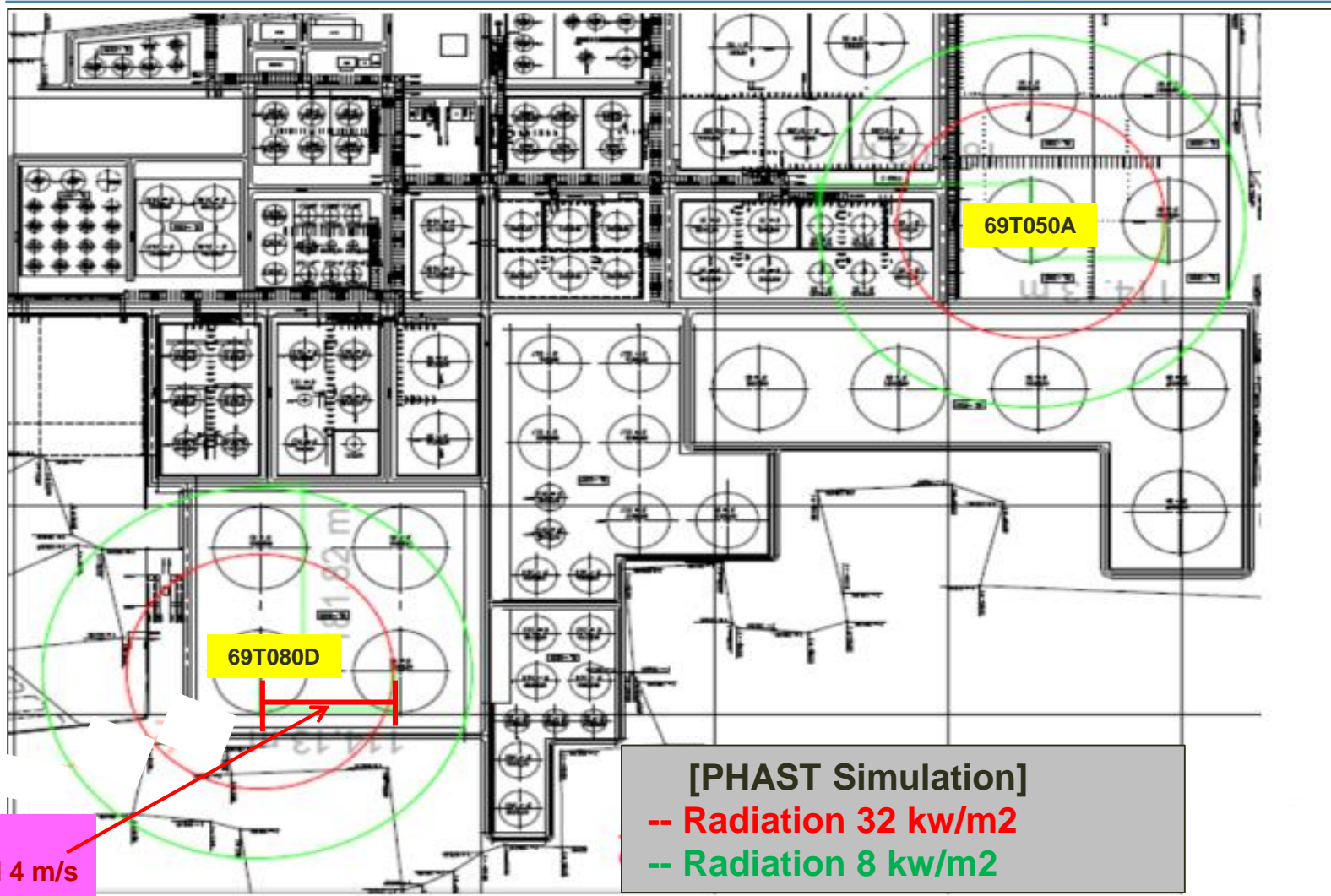
CRITERIA and STANDARD



ITEM	DETAIL	VALUE	REFERENCE	REMARK
Burning Tank	Foam Extinguishment without cooling down	<u>Foam</u> application rate [10.4 L/min/m ²]	ref. DEP 80.47.10.30, section 4.1.2.1 , LAST Fire Project	Duration 65 min.
Adjacent Tanks	Cooling Down Area Half-section of tank shell And ½ shell height]	<u>Water</u> application rate [2 L/min/m ²]	ref. DEP 80.47.10.30, section 4.1.2.1& 4.3.2.5 and NFPA 11	-
	Fixed Cooling System	Thermal Radiation >32 kw/m ²	ref. DEP 80.47.10.30- Gen	-
	Mobile Cooling Equipment under wind direction	Thermal Radiation 8-32 kw/m ²	ref. DEP 80.47.10.30- Gen	-
Oil Transfer Out	Oil transfer out of Burning tanks & Adjacent tanks is not recommended	-	LAST Fire Project	Boil-Over Concern



HEAT RADIATION LEVEL



113 M.
@wind speed 4 m/s

[PHAST Simulation]
-- Radiation 32 kw/m²
-- Radiation 8 kw/m²



4th Chemical Process Safety Sharing (CPSS)

19th June 2019, Thailand





FIRE WATER/FOAM DEMAND and SUPPLY

(69T050A)

(The largest water consumption area)



Fire Case Scenario	Equipment No.	Description	Spray Area	Application Density	Diameter	Height	Surface area	Firewater Demand		Remark
				(lpm/m ²)				(lpm)	(m ³ /hr)	
69T050A	69T050A	Burning Tank	Full Surface Fire Foam solution (Water)	10.4 (Over NFPA 60%)	80	23.65	5024	50682	3041	1.Refer DEP 80.47.10.30 sec.4.1.2.1 2. 97% of total flow
	69T050B	Adjacent Tank	Tank Shell (Half section)	2	80	23.65	2970	5941	356	Refer DEP 80.47.10.30 sec.4.1.2.1 and 4.3.2.5
	69T050D		Tank Shell (Half section)		80	23.65	2970	5941	356	
	69T005A		Tank Shell (Half section)		25.6	17.07	686	1372	82	
	69T005B		Tank Shell (Whole section)		25.6	17.07	1372	2744	165	
	2 Fire Monitors (2 x 500 GPM)									227
Total Firewater Demand									4228	

Scenario	Tie-in Point	Assign Pressure No.	Pipe No.	Discharge Pressure*	Destination Pressure	Fathom Results				
				(Seawater /Utility)		Pipe Velocity	Pressure In	Pressure Out	Peessure Drop	Flow Rate
				(barg)		(m/s)	(barg)	(barg)	(barg)	(m ³ /hr)
69T050A	1	J160	P293	11.26 / 8.67	0.6	2.71	0.78	0.56	0.22	1589.72
	2	J265	P285			1.39	0.60	0.59	0.01	817.27
	3	J272	P291			1.28	0.79	0.59	0.20	751.62
	4	J269	P288			1.86	0.79	0.58	0.21	1093.12
Total Firewater Supply						4251.72				



FIRE WATER/FOAM DEMAND and SUPPLY

(69T080D)

(The longest path of the fire water distribution system)



Fire Case Scenario	Equipment No.	Description	Spray Area	Application Density	Diameter	Height	Surface area	Firewater Demand		Remark
				(lpm/m ²)	(m)	(m)	(m ²)	(lpm)	(m ³ /hr)	
69T080D	69T080D	Burning Tank	Full Surface Fire Foam solution (Water)	10.4 (Over NFPA 60%)	80	23.62	5024	50682	3041	1.Refer DEP 80.47.10.30 sec.4.1.2.1 2. 97% of total flow
	69T080B	Adjacent Tank	Tank Shell (Half section)	2	80	23.62	2967	5933	356	Refer DEP 80.47.10.30 sec.4.1.2.1 and 4.3.2.5
	69T080C		Tank Shell (Half section)		80	23.62	2967	5933	356	
	2 Fire Monitors (2 x 500 GPM)								227	
Total Firewater Demand								3980		-

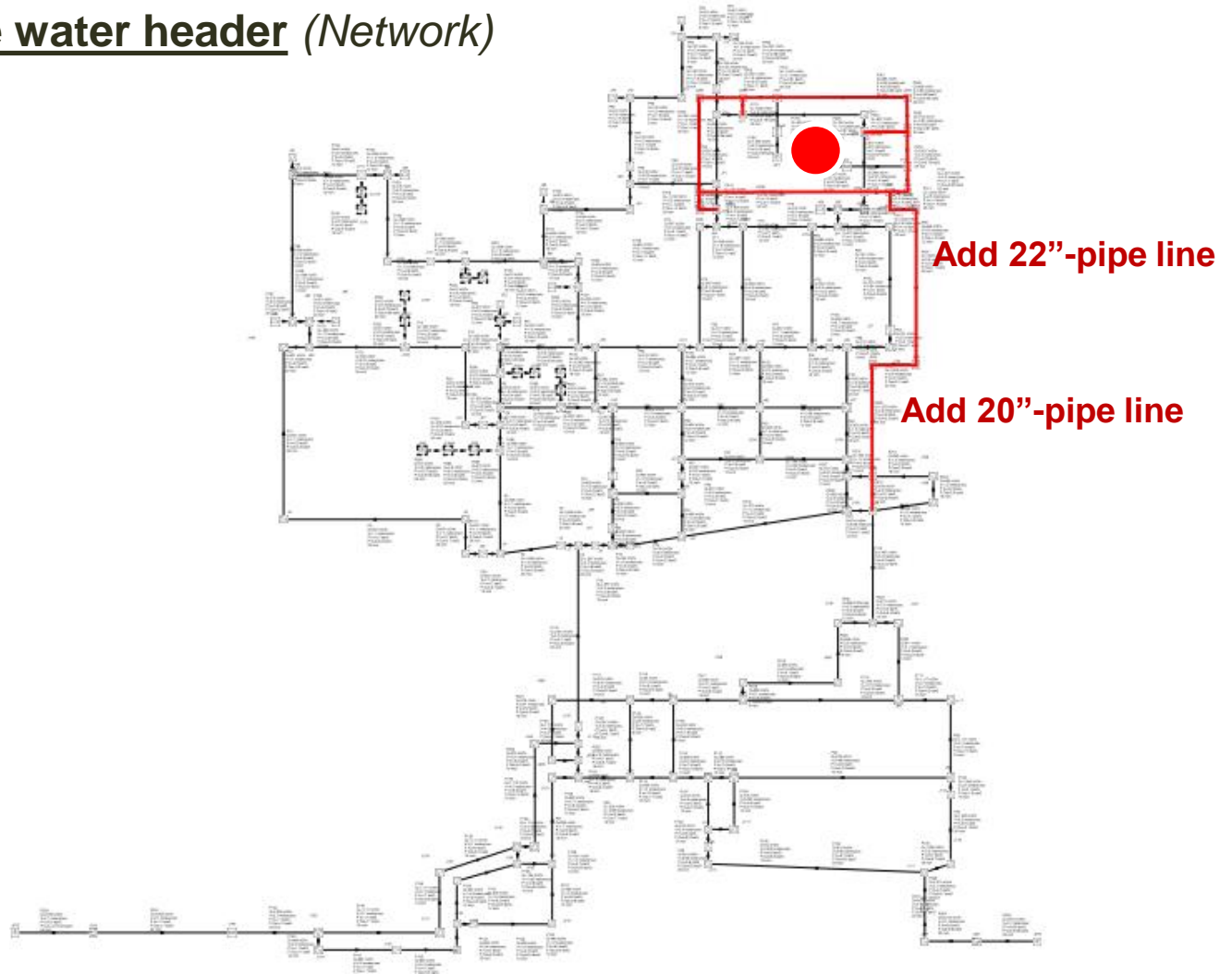
Scenario	Tie-in Point	Assign Pressure No.	Pipe No.	Discharge Pressure* (Seawater /Utility)	Destination Pressure	Fathom Results				
				(barg)	(barg)	Pipe Velocity	Pressure In	Pressure Out	Peessure Drop	Flow Rate
				(barg)	(barg)	(m/s)	(barg)	(barg)	(barg)	(m ³ /hr)
69T080D	5	J211	P180	11.94 / 9.25	0.6	4.02	0.75	0.52	0.23	947.99
	6	J212	P294			4.34	0.73	0.51	0.22	2058.60
Total Firewater Supply										3006.59



IMPROVEMENT



1. Fire water header (Network)





IMPROVEMENT



2. Hydrant manifolds

The big size (>6 inch) of Hydrant Manifolds will be prepared to **connect between WF-Header and Terminal Booster Pump(Truck)**

3. Booster pump (Truck)

3.1 Burning tank

Booster Pump : (1,000 m³/hr x 3)

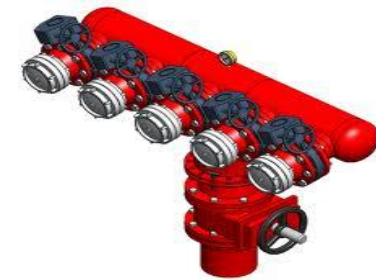
3.2 Cooling down / Adjacent tank

Booster Pump : (350 m³/hr x 3)

3.3 Pipe-rack/Adjacent structure

Booster Pump : (120-350 m³/hr x n)

#Discharge Pressure requirement 7 barg and 2 barg





IMPROVEMENT



4. Big-Gun

4.1 Burning tank

Big-gun : (1,000 m³/hr x 3)

4.2 Pipe-rack/Adjacent structure

Big-gun : (120-350 m³/hr x n)

5. Fixed cooling system (Modified)

#For booster pump connection

#Spray nozzle require pressure >2 barg.

6. Fire hose

Require fire-hose big size 6", 8" or 10" depended on water demand.

7. Road (Extend)

For filling foam





CONCLUSION



Item	Detail	Action
WF-Header	20" & 22" WF-Header addition	Need CAPEX
Hydrant Manifold	40-50 Manifold installation	
WF-Cooling Down	Modify the existing cooling system with pressure-booster	
Road & Facility	Extend road, Fire wall and other facility	
Booster pump (<i>Truck</i>)	3 sets of 1,000 m3/hr	Cooperate in PTT Group & EMAG Group.
	3 sets of 350 m3/hr	IRPC Existing Facility
	2 sets of 125-350 m3/hr	IRPC Existing Facility
Big-Gun & Hose	3 sets of 1,000 m3/hr	Cooperate in PTT Group & EMAG Group.
	2 sets of 125 m3/hr	IRPC Existing Facility



Thank you for your attention

